

# NASA TECH BRIEF

## Ames Research Center



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### G-Load Indicator and Warning Device for Aircraft

A g-load indicator and warning device has been developed to facilitate pilot control of g-load maneuvers and to provide an immediate indication of g-load constraint violations. It may be used in test flights, in aircraft simulators, or in displays of the performance of remotely piloted aircraft.

The device consists of a body-mounted accelerometer package, integrators, a body-mounted rate-gyro package, multipliers, summers, a divider, a square-root extractor, a line-drawing system, and a cathode ray tube. The acceleration along each of three orthogonal axes is measured by the accelerometers. The outputs from the accelerometers are integrated to yield the components of the linear velocity vector ( $u, v, w$ ) relative to a coordinate system fixed in the body; the outputs ( $p, q, r$ ) from the rate-gyros represent the components of the angular velocity vector relative to the same system of body axes. The components of the linear and angular velocity vectors are combined to yield the acceleration-producing component of angular velocity. The current value of the acceleration-producing component of the angular velocity vector and the critical design value are then processed by a line-drawing system, which transforms the processed data to graphical form and displays the resultant output on a cathode ray tube in the form of a circle and pointer. The radius of the circle represents the component of angular velocity that would cause structural failure, and the length of the pointer is a measure of the

magnitude of its current. No action is required if the pointer lies within the circle; if the pointer penetrates the circumference of the circle, structural damage will ensue. The circle expands as the velocity of the aircraft is reduced, indicating to the pilot that it is safe to engage in large-amplitude maneuvers; contraction of the circle with increasing velocity indicates that maneuvers must be limited to smaller amplitudes.

#### Note:

Requests for further information may be directed to:

Technology Utilization Officer  
Ames Research Center  
Moffett Field, California 94035  
Reference: TSP 74-10171

#### Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

NASA Patent Counsel  
Mail Code 200-11A  
Ames Research Center  
Moffett Field, California 94035

Source: James C. Howard  
Ames Research Center  
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